(12) UK Patent Application (19) GB (11) 2 274 054 (13) A

(43) Date of A Publication 13.07.1994

(21) Application No 9326576.7

(22) Date of Filing 31.12.1993

(30) Priority Data
(31) 9300229 (32) 07.01.1993 (33) GB

(71) Applicant(s)
Robert John Dudley Welch
First Technicare Co Ltd, 39 North Road, LONDON, N7 9DP, United Kingdom

(72) Inventor(s)
Robert John Dudley Welch

(74) Agent and/or Address for Service
Ablett & Stebbing
45 Lancaster Mews, Lancaster Gate, LONDON, W2 3QQ, United Kingdom

(51) INT CL[5]
A47C 27/14

(52) UK CL (Edition M)
A4M M1DX M1D3 M1D4

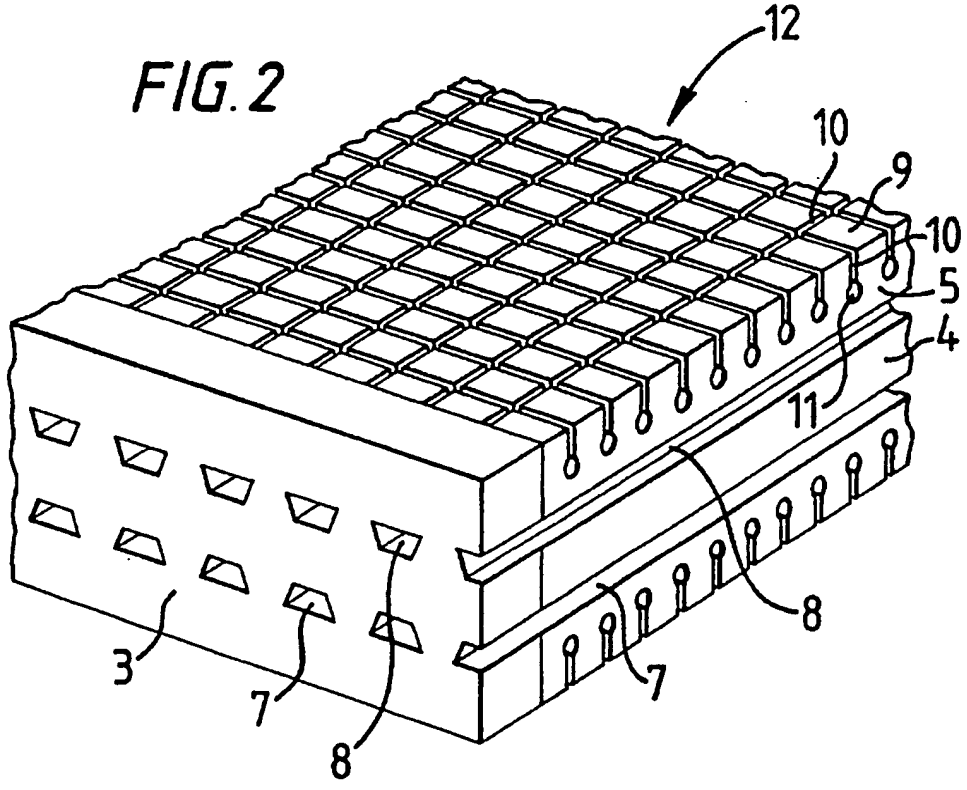
(56) Documents Cited
GB 2264050 A GB 2032269 A EP 0257982 A1

(58) Field of Search
UK CL (Edition M) A4M
INT CL[5] A47C 27/14

(54) Mattress

(57) A patient support mattress (12) comprises a plurality of layers (3, 4, 5) of open-cell foamed synthetic plastics material, said mattress being provided with air passages (10, 11) extending therethrough for the dissipation of moisture characterised by a plurality of longitudinal channels (7, 8) each extending from one longitudinal edge (3) to another longitudinal edge (3). The invention assists in the dissipation of moist air from the mattress even when the patient is lying still.

FIG. 2



GB 2 274 054 A

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

FIG. 1

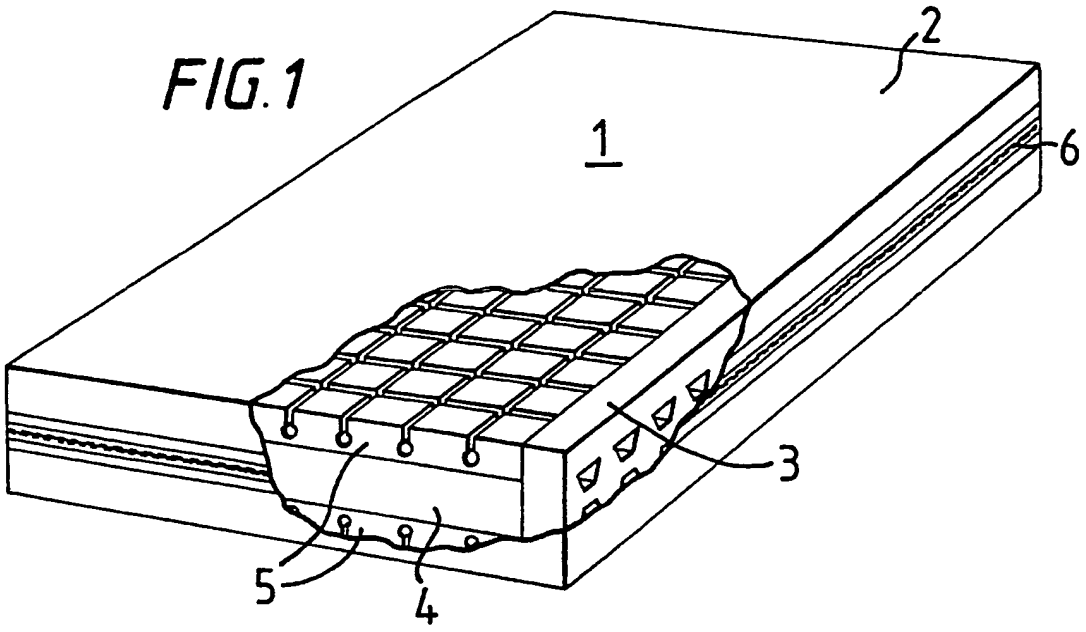
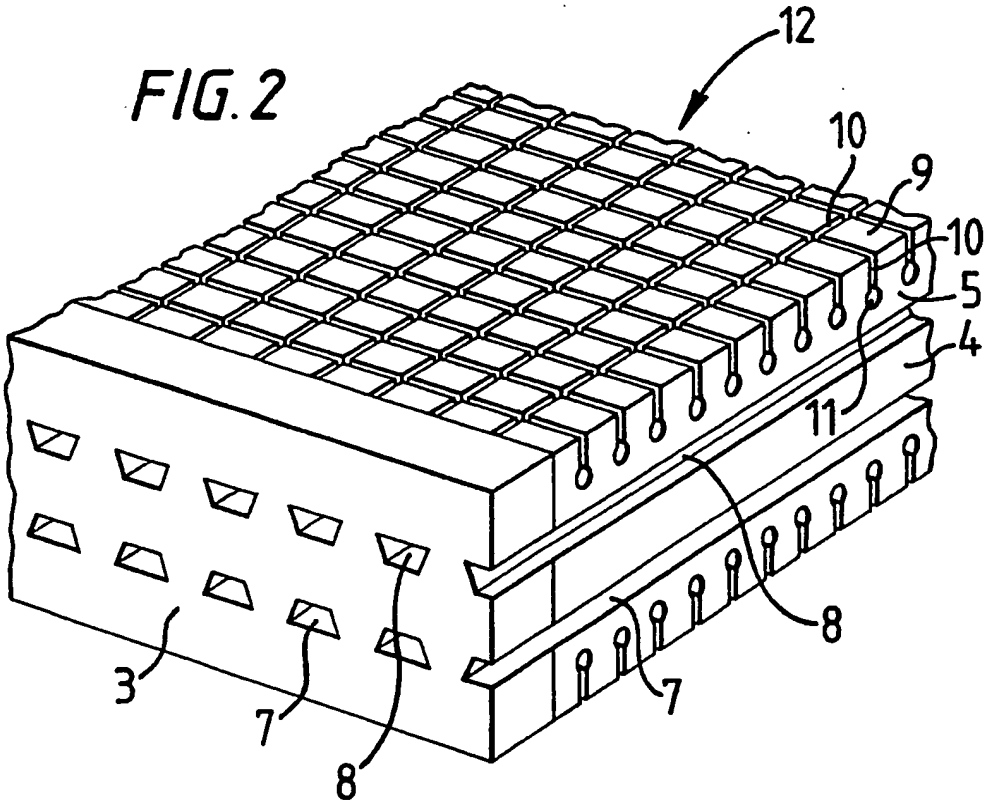


FIG. 2



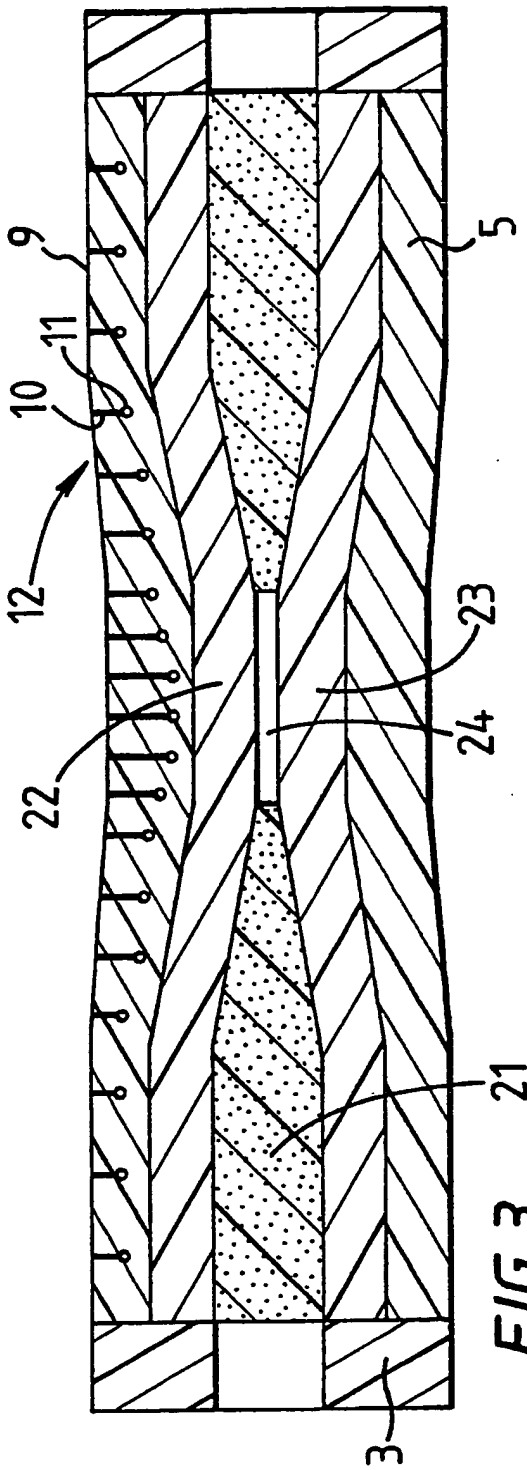


FIG.3

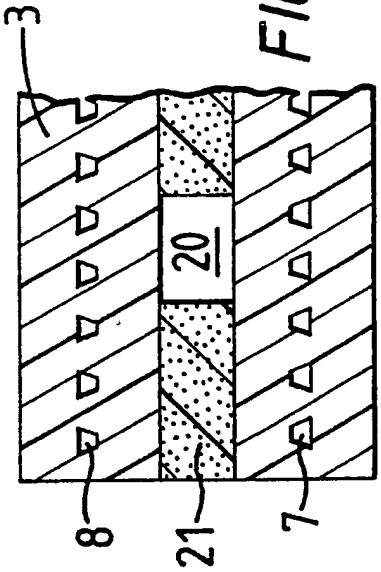


FIG.4

PATIENT SUPPORT MATTRESS

The present invention relates to a patient support mattress, and particularly to a patient support mattress for the alleviation of bed sores.

The problem of bed sores in patients, particularly long-stay elderly patients, has long been recognised. Hospital beds have usually been provided with a metal pan, upon which rests a standard foam mattress with a water-repellent but vapour-permeable covering thereupon. Usually the foam utilised is a polyurethane open cell foam.

As will be appreciated, over a period of time water vapour penetrates the covering and enters the open cell foam. Because it is difficult for the moisture to evaporate from the mattress in these conditions, and because some patients tend to lie comparatively still, heat, pressure and moisture are applied to the open cell foam which, over a period of time, reduces resilience and causes the foam to set into a compressed state thereby reducing resilience of the foam and exacerbating the problem of bed sores. Dealing with bed sores can be difficult and time consuming and, of course, blocks the bed for new patients.

Mattress covers for the beds as previously indicated may be provided with a vapour-permeable membrane over the foam. This allows the foam to breathe, but in order to prevent distortion of the mattress itself, it has been proposed to use a vapour-permeable and resilient foam cover.

The general problems of the prevention of bed sores have already been addressed, for example in GB-A-2132083, by providing a patient support mattress formed with a plurality of layers of open-cell foamed synthetic plastics material, said mattress being provided with air passages extending therethrough for the dissipation of moisture.

However, this arrangement is deficient in that the longitudinally extending passage revealed therein tends to become blocked because of the weight of the patient. In this disclosure this drawback is dealt with by providing, as an essential feature of the invention, a plurality of vertically extending channels for moisture dispersal.

The difficulty with this is that hot air rises and also carries the most moisture. Thus moisture laden air tends to become trapped for long periods at the juncture of the vertical and longitudinally extending passages if the patient lies still. This is because the longitudinal channel becomes blocked by the patient's weight.

Thus, wet compression set can still occur, although to a reduced degree, in mattresses of this sort. Again, as revealed in GB-A-1596157, patient support mattresses have been available for some time wherein a physically porous material such as nylon or terylene are used as the mattress cover but both in this case and in the previously discussed prior art an open grid-like structure needs to be provided as a bed base.

Recently, patient support mattresses have appeared formed of a soft resilient open-cell foam and provided with an upper surface comprising an insert of a plurality of zones defined by deep cuts in the body of the foam, said cuts intersecting at regular intervals to define zonal portions. Because these zonal portions are structurally independent of each other, point loading by a part of a patient's body is significantly reduced, and moisture-laden air is encouraged to leave the mattress by means of more longitudinal annular passages associated with the deep cuts, responding to body movement.

However, these patient support mattresses are formed upon an H-shaped core of a harder support foam. The sides of said H-shape serve to retain said zonal insert in the lateral

direction, thus allowing only the channels extending longitudinally, as opposed to laterally, to vent to the exterior. Again, when the patient is lying on the mattress, point loading occurs particularly over the upper torso and pelvic regions, also the area of highest moisture generation. Because the weight of the patient tends to obdurate the small annular channels extending longitudinally there is no freeflow of air to clear the moisture from the patient support mattress because if the patient is lying down the longitudinal channels must almost always be obturated at some point. Accordingly, wet compression set can also occur.

The present invention is characterised in a first aspect by a plurality of longitudinal channels, which each extend from one longitudinal edge of the mattress to the other longitudinal edge. The arrangement ensures that whenever the patient moves moist air is expelled from one side or the other of the mattress while drying air is drawn in from the other edge.

The channels preferably have a trapezoidal or triangular cross section because patient weight, when acting thereupon, is less likely to completely obturate the passage formed. Indeed, it is a preferred design feature of the present invention that the foam configuration is adapted to make it unlikely that point loading will obturate any channel except in exceptional circumstances. Preferably the narrower end of the trapezoidal or triangular cross sectional shape is directed away from the nearest patient contact surface of the mattress.

In a further feature of the invention there are provided at least two sets of lateral channels vertically spaced apart, and most preferably offset from each other. Since the open-cell foam from which the mattresses of the present invention are formed allow for migration of moisture according to a moisture transfer gradient, the arrangement of the present invention, since it assists in entry of dry air into the

mattress allows the pick up of moisture and its expulsion using the voluntary and involuntary movement of the patient in a pumping action.

Another aspect of the invention provides a pair of opposed longitudinally extending foam wedges, the narrower portions of said wedges being juxtaposed, preferably to define a longitudinal channel.

Where two sets of lateral channels are used, a further effect comes into play. With the patient in situ upon the mattress, the whole mattress however well designed, will deform downwardly over the torso and pelvic region; the regions of highest moisture generation. The consequent of this is that the lateral channels slope slightly upwardly toward their longitudinal edges. Since the point of contact between the torso and the pelvic region is also the point of maximum moisture transfer, the upper lateral channels in this region are both warmest and moistest. This causes the moist air to be expelled more readily even when the patient is lying quite still, because air usually below the patient can be replaced from the lower lateral channel via the open-cell foam in between, thus an air convection occurs within the mattress even when the patient is still, assisted by the relative inter-relationships of the channels.

In general accord with prior art arrangements, the present invention may make use of an H-shaped support form with zonal inserts acting as patient contact areas, while the longitudinal edges of the H-shape provide a rolling resistance for the patient. However, in the present instance the H-shaped edges of the support are pierced at regular intervals by the lateral channels.

In a preferred form of the invention the longitudinal edges are formed of a high density foam to accentuate the lateral stability of the mattress. If desired, the lateral channels

may be supplemented by one or more longitudinally extending channels if considered desirable for special purposes.

The foam of the insert panels is most preferably of the zonal "chequer-board" type, as discussed above, and is preferably formed of a soft-open celled polyurethane foam having a density of 30 - 35Kg\m^3, the central portion of the mattress between the two zonal portions and having the lateral channels disposed therein preferably has a density of 34 - 50Kg\m^3, while the longitudinal edges preferably are formed of a hard chipfoam having a density of 60 - 90 Kg\m^3.

The invention will now be described, by way of illustration only, with reference to the accompanying drawing wherein

Figure 1 shows a side elevational view of a mattress in accordance with the present invention, with part of the mattress cover removed,

Figure 2 shows top left-hand corner of said mattress in side elevation,

Figure 3 shows a vertical section through a second form of the invention with channels not shown, and

Figure 4 shows a side elevational view of the arrangement of Figure 3.

With reference to Figures 1 and 2, a patient support (1) is formed with a mattress cover (2) to have standard dimensions for co-operation with the standard hospital bed. The depth of the mattress (2) also conforms to the standard parameters. Mattress cover (2) is provided with a zip extending about its shorter side and is provided about its zip with an air permeable material to allow air to readily pass therethrough. The rest of the mattress cover (2) is formed of barrier technology fabric with a microfine weave adapted to protect the foam from blood and other large droplets, but to allow moisture to permeate therethrough.

With particular reference to Figure 2, mattress (1) is formed

of a high density edge foam block extending along each longitudinal side of the mattress and being pierced at regular intervals by channels (7) and (8) which are spaced vertically apart from each other and offset so that no channel is immediately opposite another in the vertical sense. Other arrangements wherein the channels are opposite each other work satisfactorily, but necessitate more dense foams. Channels (7), for example, are all formed with a trapezoidal cross section, the longest edge of the trapezoidal cross section being directed toward the contact surface. The upper channel (8) is similarly provided by the narrower portions of the channel facing each other. The channels (7) and (8) extend laterally through the medium density support foam extending between the two longitudinally extending support foam blocks (4).

Disposed upon the support foam (4) and bounded at each longitudinal edge by the foam blocks (3) is zonal insert (12). The zonal insert (12) is formed of a soft material (5) and is provided with a "chequer-board" arrangement of deep cuts forming a blind channel (10) terminating at its innermost portion in a zonal annulus (11) which extends along the length of the blind channel thereby terminating it. Intersections of the blind channels (10) form zones (9) which are independently deformable dependent upon the weight exerted by a patient in use. It will be appreciated that the zonal annuli terminating the blind channels can expel some moist air at the remote ends of the mattress, but that they are blocked longitudinally since were this not the case the patient would tend to roll from the mattress in use.

In use, the foam mattress of Figure 2 is disposed with a mattress cover (2) as hereinbefore set forth, and the mattress placed upon a standard hospital bed with a metal pan base. The mattresses may also be utilised on a grid base, but this is not necessary.

With the patient in situ upon the mattress so disposed, weight is applied by the patient's torso and pelvic regions to the zones (9) via the resilient mattress cover (2). The zones (9) respond by picking up the pressure signature of the patient concerned, thereby spreading the load as far as possible and preventing incidental point loadings. This has the desirable effect of avoiding, in so far as is possible, bed sores. However, in itself the arrangement is insufficient for the dissipation of moisture, particularly if the patient is sweating profusely.

Accordingly, because the mattress cover is vapour-permeable, although moisture-resistant, moisture penetrates the zones (9) and is transferred into the blind channel annuli (11) from which some air may be expelled by a pumping action at the remote ends of the mattress, but the central portions of moist air remain essentially still trapped. Accordingly, a moisture gradient is set up which extends inwardly of the foam until it reaches the upper surface of the upper channel (8).

With the patient lying on the mattress, the upper surface of the upper channel (8) deforms downwardly against the trapezoidal shape of the channel thereby causing a partial obturation, but only a partial obturation, of the channel beneath the torso and pelvic regions of the patient. As the patient moves the upper surface of the channel flexes upwardly, or downwardly, thereby providing a pumping action which passes air across the surface of the channel (8) thereby taking up moisture as it goes. If the patient rolls over, air will be readily expelled on one side and drawn in on the other and vice versa. However, in some circumstances the patient lies absolutely still. In these circumstances the central portion of the mattress will be slightly deformed to form a very shallow V-shape. This also affects the orientation of the channel (8) such that it extends in a slightly upward direction along its longitudinal edges. Because the upper channels are warmer than the lower channels, by virtue of the

transmitted heat from the patient, warmer air tends to absorb moisture and will tend to flow out of the mattress even if pumping is not occurring. The air moving from the upper channel (8) is replaced by air filtering through the open-cell polyurethane foam from the lower channel (7) at a lower temperature. The relatively cold air filtering upwards is then warmed and replaced so that the cycle continues. This cycle cannot occur in the prior art arrangements.

The foregoing arrangement is developed in Figures 3 and 4 wherein like elements have been given like numerals and will not be described further.

With reference particularly to Figure 4 it will be noted that this corresponds with the arrangements shown in Figure 2 with the exception that a high density foam wedge (21) devides foam block (3). The wedges (21) are interspersed with optional lateral channels (20) to assist air transfer.

As best shown in Figure 3 longitudinal edge foam blocks (3) are additionally provided with inwardly directed foam wedges (21) which are formed of the same or a harder foam material (21). The wedge shaped inserts (21) have their narrow edges in juxtaposition but spaced apart to define a longitudinal air channel (24).

By virtue of the wedges (21) the foam material (4) as shown in Figures 1 and 2 is divided to form an upper foam layer (22) and a lower foam layer (23).

Similarly to the arrangement shown in Figures 1 and 2 a zonal insert (12) is similarly provided with blind channels (10) terminating in annulii (11) to define zones (9) therebetween. It will be noted that zones (9) have a narrower configuration towards the centre portions of the mattress where the most weight can be expected to be exerted. Since maximum point loading is to be found in use over the shoulder and pelvic

areas it is often only necessary to provide smaller zonal areas (9) over these portions of the mattress.

In use a patient is positioned generally centrally of the mattress shown in Figure 3. Because of the small surface area of the zonal portions (9) in the central portion, point loading at that position is kept to a minimum, or put in another way weight transference is increased to a maximum as is commensurate with the structural stability of the mattress in the long term. It will also be observed that in Figure 3, the central portion of the mattress are narrower in a vertical sense than the edge portions. The effect therefore of a patients weight is to depress the layers (22) and (23) relatively to the rest of the mattress. The patients weight will also tend to obturate at least portions of the longitudinal air passage (24) but this is not of great significance. The effect of the relative movement of the central portions of the mattress is to increase the angles of inclination of upper channels (8) while also reducing the angles of inclination of channels (7). This is not however significant because the depression of the mattress will only have the effect of rendering the channels (7) generally horizontal and in any event the purpose of channel (7) is to allow air to penetrate the centre portion of the mattress and hence allow moist air to more readily exit to the exterior via channels (8) by replacing the air at the central portion. The air channel (24) assists in this transfer even if it is partially obturated.

By means of the arrangement in accordance with the present invention, we have found that wet compression set is at least substantially alleviated and the prevalence of bed sores reduced.

The invention relates therefore to a patient support mattress as just described, and to a method for assisting moisture removal from a patient support mattress.

CLAIMS

1. A patient support mattress comprising a plurality of layers of open-cell foam synthetic plastics material, said mattress being provided with air passages extending therethrough for the dissipation of moisture;
characterised by a plurality of longitudinal channels each extending from one longitudinal edge of the mattress to the other longitudinal edge.

2. A mattress according to Claim 1 wherein the channels have a trapezoidal or triangular cross section and wherein the narrower end of the trapezoidal or triangular shape is directed away from the nearest patient contact surface of the mattress.

3. A mattress according to either of Claims 1 or 2 comprising at least two sets of lateral channels vertically spaced apart and offset from each other in the vertical sense.

4. A mattress according to any preceding claim comprising a pair of opposed longitudinal extending foam wedges; the narrower portions of said wedges being juxtaposed.

5. A mattress according to Claim 4 wherein the opposed narrower juxtaposed portions of the wedges are spaced apart to define a longitudinal channel.

6. A mattress according to any preceding claim comprising a zone or insert at the surface adapted for patient contact, said zonal insert being provided with means for decreasing point loading over selected areas.

7. A mattress according to any preceding Claim formed of at least two foam materials of a different density, said foam materials comprising a higher density longitudinal edge

support foam, and a lower density support comprising the patient contact surface.

8. A mattress according to Claim 4 comprised of three separate foam layers, a high density longitudinally extending edge portion, an intermediate density laterally extending support, and a soft foam zonal insert acting as the patient contact area.

9. A method of assisting moisture expulsion from a patient support mattress formed of a foam material which comprises forming at least two sets of laterally extending channels from one longitudinal edge to the other, said channels being spaced apart in the vertical sense, whereby heat and moisture gradients imposed by positioning a patient on the contact surface of the mattress results in convection of moisture-laden air in the upper channels as a result of air transfer in the zone beneath the patient within the mattress from the lower channel, even with the patient lying immobile.

10. A method according to Claim 9 which comprises supporting the edges of the patient support mattress to accentuate downward central flexion of the mattress thereby to increase the angular inclination of the channels in response to patient weight.

11. A patient support mattress substantially as herein before set forth with reference to, and/or as illustrated in, Figure 1 and 2 or 3 or 4 of the accompanying drawings.

Patents Act 1977 Examiner's report to the Comptroller under Section 17 (The Search report) -12-	Application number GB 9326576
Relevant Technical Fields (i) UK Cl (Ed.M) A4M (ii) Int Cl (Ed.5) A47C 27/14	Search Examiner M J PENNELL Date of completion of Search
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii)	Documents considered relevant following a search in respect of Claims :- 1-8,11

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
P,X	GB 2264050 A	(GILBERT) see eg Figure 3	1
X	GB 2032269 A	(LAM SUN NG) see eg Figure 3	1
X	EP 0257982 A1	(SPAN-AMERICA) see Figures 1,2	1

Databases:The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).